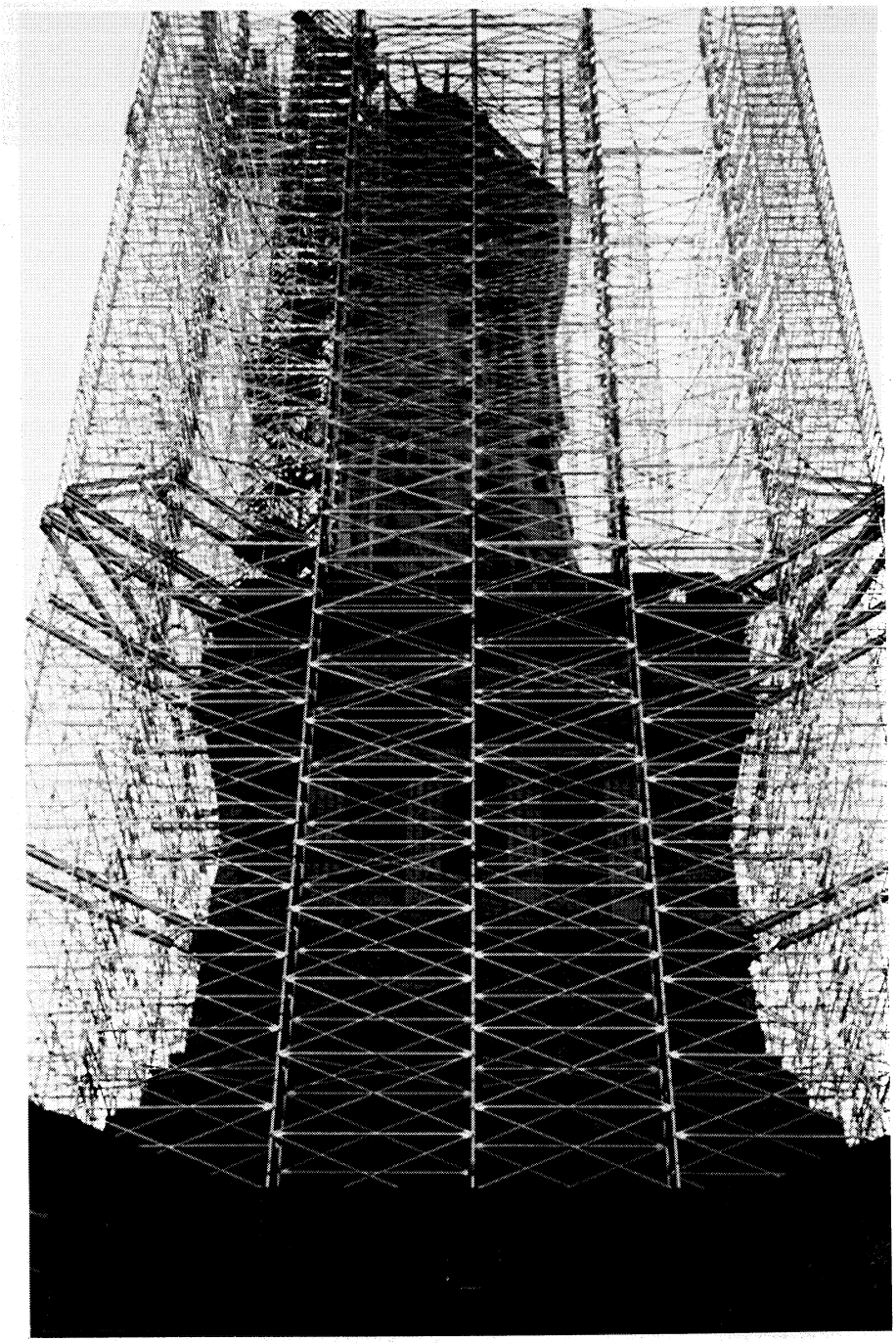
Among spinoffs for structural security and public safety is a corrosion resistant coating for America's symbol of freedom

New Life for Miss Liberty

On October 28, 1886, President Grover Cleveland led a million Americans in the dedication of the Statue of Liberty, a gift from the people of France intended to symbolize American freedom. Next Fourth of July, to commemorate Miss Liberty's 100th anniversary, the statue will be rededicated after extensive renovation and refurbishment. Among many rejuvenating measures designed to repair the ravages of a century and insure Miss Liberty's long-term survival is a protective coating that originated in NASA research on corrosion resistant materials.

Liberty's designer, French sculptor Frédéric Auguste Bertholdi, once boasted that his creation would last as long as the pyramids of the Nile. But Bertholdi reckoned without the degradation caused by the cumulative effect of construction flaws, accidents, two million visitors a year and the corroding impact of salt spray, fog and atmosopheric pollution. In 1980, a close inspection by the National Park Service, Liberty's custodian, revealed signs of corrosion and other deterioration of the structure. Though not immediately threatening, the damage was sufficient to warrant action. A French-American Committee for Restoration of the Statue of Liberty was formed to draw up an architectural-engineering rehabilitation plan. Spearheaded by Chrysler chairman Lee Iacocca, an effort to raise restoration funding from private sources was organized and the Liberty life-extension program was set in motion.

The monument is being



rehabilitated from pedestal to torch. The century-old structural steel skeleton is being reinforced where needed with modern stainless steel alloys. The statue's copper skin is getting a thorough cleaning and seams in the skin are being closed with a sealant for improved weather resistance. Tests of the skin showed it had weathered well so, in order to preserve the historic blue-green patina, the planners rejected application of exterior protective films. However, corrosion protection is being provided for the interior structure by a primer coating known as IC 531, an aerospace spinoff product manufactured by Inorganic Coatings, Inc., Malvern, Pennsylvania. The coating was developed by Goddard Space Flight Center as a means of protecting gantries and other structures at NASA's primary launch site, Kennedy Space Center (KSC).

KSC is located on Florida's Atlantic Coast, thus its launch facilities require greater corrosion protection than is needed inland because of constant exposure to salt spray and fog. Seeking to reduce maintenance costs at KSC, Goddard conducted a research program aimed at development of a superior coating that would not only resist salt corrosion but also protect KSC launch structures from the very hot rocket exhaust and the thermal shock created by rapid temperature changes during a space launch. The successful research effort produced a new type of inorganic coating.

Goddard's research in the early 1970s was based on chemistry first investigatged in the 1940s. Although the early chemistry proved very effective against corrosion, it was not practical to apply or cure in a production situation. NASA's development of a high-ratio 5.3:1 potassium silicate solved all of the practical application problems while improving on the original silicate/zinc chemistry. The new high-ratio formula provided economical, long-term protection with a single application in a marine environment.

In 1981, NASA granted a license for the coating to Shane Associates, Inc., Wynnewood, Pennsylvania. The following year, Inorganic Coatings signed an agreement to become sole manufacturer and sales agent under the Shane license. The latter company assigned the trade name IC 531 to the NASA compound.

Because IC 531 is water-based, it is non-toxic, non-flammable and has no organic emissions. The high ratio silicate formulation bonds to steel and in just 30 minutes creates a very hard ceramic finish with superior adhesion and abrasion resistance. It mixes and applies easily with standard equipment and thus offers advantage in fewer labor hours per application.

Of particular importance is the compound's long lifetime. Although commercial applications by Inorganic Coatings are relatively recent, hence provide no long-term results, the coating has shown outstanding corrosion resistance in a number of test applications over the past decade. It has been tested in severe environments around the world, for example, in laboratory salt spray chambers; on test panels at Kennedy Space Center; on bridges, such as California's Golden Gate and Oregon's Astoria River Bridge; and on antenna installations in California, Hawaii and Canton Island in the South Pacific. Inspections made five to nine years after application showed coated structures virtually free of corrosion, and thickness measurements disclosed almost no film loss despite long exposure to sun, moisture and salt.

Obscured by scaffolding, the Statue of Liberty (far left) is undergoing extensive renovation and refurbishment after discovery of deterioration caused by corrosion and other factors. Among life-prolonging measures is a long-life corrosion resistant coating being applied to the interior structure. Known as IC 531 and manufactured by Inorganic Coatings, Inc., it is easily mixed on site (lower left), easily applied (below) and has superior adhesion and anti-abrasion characteristics.